

Lessons for the safe implementation of automation in mining

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ABSTRACT

A global review of mining automation experiences was undertaken on behalf of the National Institute for Occupational Safety and Health. The research included a review of literature and guidance materials; analysis of automation related incidents; visits to surface and underground mines in Australia, Brazil, Chile, South Africa, Sweden, and the USA; and discussions with key informants.

The safety and health benefits of mining automation are undeniable. Automation also provides increased productivity through increased consistency of equipment operation and increased equipment utilisation rates.

However, the introduction of automated components introduces new failure modes. Examples of mechanisms associated with automation that have potential for adverse safety and health outcomes include:

- Software shortcomings
- Communication technology disruption
- Cyber security breach
- Unauthorised access to autonomous zones
- Loss of manual skill
- Over-trust
- Input errors
- Inadvertent mode changes
- Complex interactions
- Sensor limitations
- Lack of system awareness of environment
- Loss of situation awareness
- Distributed situation awareness challenges
- Communication difficulties
- Workload
- Musculoskeletal injury risk factors

Effective risk management requires analyses of these potentially harmful situations during system design. The analyses should include task-based risk assessments involving a range of operators and others effected by the system, and systems-based techniques, in addition to conventional hazard based risk analysis techniques. As far as possible, the risks should be reduced during system design. Residual risks need to be understood by mine management to allow effective controls to be devised, implemented, and monitored.

Human systems integration processes should be implemented during acquisition of automated mining equipment (Burgess-Limerick, 2020). Issues of particular importance include the design of interfaces to maintain situation awareness, and the training of people who will undertake new roles. Vendors should be required to submit an human systems integration program plan during the preparation of proposals to implement any new technology at mines.

Reference

Burgess-Limerick, R. 2020. Human-systems integration for the safe implementation of automation, *Mining, Metallurgy & Exploration*, 37: 1799-1806. <https://doi.org/10.1007/s42461-020-00248-z>